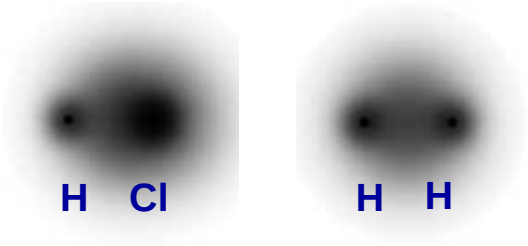
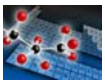
Electronegativity & Bonding (pg. 70-74)

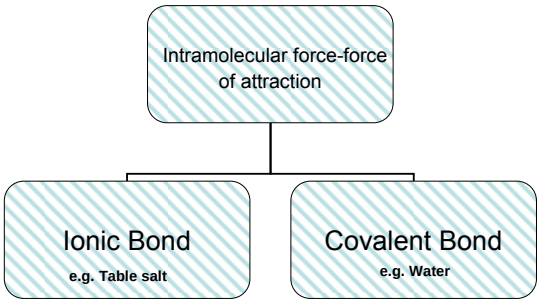




Chemical Bonds

- Atoms form bonds in order to become stable, and isoelectronic with a noble gas.
- A chemical bond is the glue which holds two or more atoms together to make substances
- When atoms interact to form a chemical bond, only their outermost regions are in contact.
- The outermost (valence) electrons are involved in bonding.

Overview of Chemical Bonding



Recall-Types of Bonds

- **Ionic bond** - formed by the attraction between positive and negative ions - it is electrostatic in nature. Electrons in this type of bond spend and move towards the atom with the stronger pull for them (most electronegative atom)

- **Covalent bond** - a chemical bond formed by the sharing of a pair of electrons between atoms.
  The electrons in a covalent bond may be shared equally (pure covalent) or unequally (polar covalent).

Properties of Ionic and Covalent Compounds

Property	Ionic Compounds	Covalent Compounds
state at room temperature	solid	solid, liquid or gas
melting point	high	low
electrical conductivity as a liquid/solution	yes	no
solubility in water	most are very soluble	most are not very soluble

Electronegativity

- Electronegativity is a measure of how strongly an atom attracts the bonding electrons in a chemical bond.
- Each element in the periodic table has electronegativity value.
- The higher the electronegativity, the stronger an atom's attraction for bonding electrons.

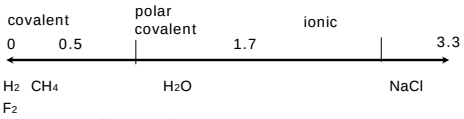
Understanding trends in Electronegativity

- Based only on the position of the elements in the periodic table, arrange them in order of increasing attraction for electrons in a bond.

e.g. Na, Fr, F, K, B

Bonding Continuum

- The difference in electronegativity determines the type of bond between two atoms. It is a continuous scale.
- We can determine the nature of a bond based on ΔEN (electronegativity difference)
- Subtract the electronegativity of one atom from the electronegativity of the other (no negative numbers).
- ΔEN = higher EN – lower EN



- A bond difference of 0.5 or less is considered to be **pure covalent** [equal sharing of electrons]
- A bond difference between 0.5 to 1.7 is considered to be **polar covalent** [unequal sharing of electrons]
- A bond difference of 1.7 or greater is considered to be **ionic** [loss and gain of electrons]

Sample problem #1 :
Predict bonding type using electronegativity for phosphorus and ixygen
(fig. 3.6 in text)

- **Step 1**: Find the electronegativities using the table: O = 3.5 and P = 2.2
- **Step 2**: Find the electronegativity difference (ΔEN = E1 – E2): ΔEn = 3.5 – 2.2 = 1.3
- **Step 3**: Analyze/conclude: 1.3 is >0 but <1.7. Therefore the bond is Polar Covalent

Sample problem #2: Predict bonding type using electronegativity for calcium and chlorine

- **Step 1:** Find the electronegativities using the table: Ca = 1.0 and Cl = 3.0
- **Step 2:** Find the Electronegativity difference (ΔEn = E1 – E2): ΔEn = 3.0 – 1.0 = 2.0
- **Step 3:** Analyze/conclude: 2.0 is >1.7. Therefore the bond is ionic and there is a complete transfer of electrons.

Example problem: Electronegativity (classwork)

Find the electronegativity differences ΔEN between HCl, CrO, Br_2, H_2O, CH_4, KCl and use this information to determine the type of bonding present in each molecule or compound.

Example Solution: Electronegativity

HCl:	ΔEN= 3.0 – 2.1 = 0.9	polar covalent
CrO:	ΔEN= 3.5 – 1.6 = 1.9	ionic
Br_2:	ΔEN= 2.8 – 2.8 = 0	covalent
H_2O:	ΔEN= 3.5 – 2.1 = 1.4	polar covalent
CH_4:	ΔEN= 2.5 – 2.1 = 0.4	covalent
KCl:	ΔEN= 3.0 – 0.8 = 2.2	ionic

HOMEWORK pg.